NATURAL GAS FED PC25C FUEL CELL POWER PLANT

FINAL REPORT FOR THE U.S. DEPARTMENT OF ENERGY

Covering Field Experience

from 01/28/98 up to 03/29/99

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ABSTRACT

This report details the performances obtained during forteen months of operation by the Natural Gas Fed PC25C™ Power Plant installed in the city of Oranienburg (Germany).
The owner of the power plant is Stadtwerke Oranienburg.
Information is provided on the resulting electrical and thermal performances, reliability and Mean Time Between Failure factors and moreover an evaluation and details of the cost benefits.

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

Stadtwerke Oranienburg started operation with PC25C™ phosphoric acid packaged fuel cell power plant in January 1998.
This power plant was the sixth natural gas fed PC25C installed in Germany, the European country where most of PC25C power plants are installed.
Up to now PC25™ (A and C model) power plants installed in Europe are twenty-one and they have exceeded 1600000 operating hours; the total electrical energy produced is about 251000MWh.
The same performances of model A, B and C (operating hours and total electrical energy produced) are respectively 2500000 hours and 390000 MWh, all over the world.
Although power plant technology is innovative, the resulting field experience clearly confirms that ordinary types of service personnel can successfully operate and maintain fuel cell power plants.
Contributing factors to this feature are:

?? control interfaces coupled with remote monitoring via computer modem
?? event logging assistance by run-rolling memory for troubleshooting

2. INTRODUCTION

Benefits of electrochemical energy conversion from phosphoric acid fuel cell power plants are:

? very low pollutant emissions

? relatively high efficiency in the sub-megawatt range

? low noise and vibration.

?? high reliability

The very low level of pollutants is due to the electrochemical process of fuel cells instead of combustion processes necessary for normal energy generation.

The normal generators convert the fuel' s chemical energy first into thermal energy and then into electricity via a rotating generator. Electric production from a phosphoric acid fuel cell takes place at lower temperature and is not subject to the efficiency limitation of normal generation.

The static nature of fuel cell electrochemical process allows such plants to have a low noise vibration level.

The lack of big rotating machines decreases failure probability so as to improve the reliability.

3. RESULTS AND DISCUSSION

The values of the parameters indicated afterwards are related to the period starting from 01/28/1998 up to 03/29/1999

THERMAL OUTPUT

The fuel cell 9157 in Oranienburg utilizes about 73 kW of thermal output of the power plant. The return and supply temperatures of the hot water loop are about 63/73°C.
In the reported period the thermal output was as follows:

CUMULATIVE THERMAL PRODUCTION
2572.5 MWh

USEFUL THERMAL PRODUCTION
496.7 MWh

CUMULATIVE ELECTRICAL PRODUCTION
1579.8 MWh

MEAN TIME BETWEEN FAILURES

The longest continuous run occurred for an amount of 2904 hours.

The reported period has 10200 h and the fuel cell operation hours were 8099 h.
The availability was 78% since startup and 98% during 1999: The actual operations promises to get better results.

The estimated Mean Time Between Failure is 556 hours.

COST BENEFITS

For the fuel cell project in Oranienburg the costs are the following:

Non recurring costs = (Fuel cell power plant foundation, costs for planning....)	1,800,000 DM
Operating costs =	151,390 DM
Heat benefit =	22,351 DM
Benefit by delivering electrical energy =	442,344 DM

Evaluation based on heat benefit of 0.045 DM/KWh and electrical benefit of 0.28 DM/KWh

The total cost benefit balance without non recurring costs is 268,603 DM

4. CERTIFICATION

CLC S.r.l. and Stadtwerke Oranienburg certify that it has complied in all respects with the grant under DE-FG21-96MC33363, Climate Change Fuel Cell Program and that the related efforts required by that grant are now fully complete including twelve months of operation and submission of the Final Report herein supplied. Such report is in compliance with Paragraph 4 of DoE's Special Terms and Conditions for Research Projects Grants for Climate Change Fuel Cell Program.

5. CONCLUSIONS

Distributed generation are increasing utility industry and customer attention.
ONSI PC25C phosphoric acid fuel cell power plant seems to be a very good choice for those applications such as hospitals, health care facilities, selected or isolated locations having grid capability constraints and communication facilities.

PC25C fuel cell power plant benefits can be summarized as follows:

?? High electrical and thermal efficiency

?? Low level environmental pollution (emissions, noise level, vibrations)

?? Possible utilization of different fuels (natural gas, hydrogen, propane, biogas)

?? High quality output electrical power

?? Relatively small dimensions compared with other applications of different fuel cell technology

?? Cheap power plant installation with no need of big work

?? Quick and short time for start up

?? Easy scheduled maintenance (quarterly and yearly)

In the PC25C it is possible to perform the quarterly maintenance without stopping the power plant.